Relationship Between the Protein Content in the Submaxillary Salivary Gland Tissues and Mucosa over the Secretory Cycle for Acute Inflammation of the Oral Soft Tissues

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During acute inflammations of the oral soft tissues, the secretory activity of the salivary glands markedly changes. At the same time, the salivary content of immunoglobulins and lysozyme increases [1,2]. However, it has not been elucidated at what stages of inflammation the tissue defense mechanisms, which are associated with the accumulation of proteins (including protective ones) in the mucosa, are involved, and to what extent this is connected with the protein content in the glandular tissue and its excretion with the saliva during induced secretion.

MATERIALS AND METHODS

The experiments were carried out on 63 nonpedigree rats of both sexes weighing 150 g. The animals were divided into the following experimental groups: 1) intact animals with spontaneous (basal) saliva secretion; 2) intact rats with induced salivary secretion (pilocarpine in a dose of 1 mg/kg body weight, subcutaneously; 3 and 4) rats with basal saliva secretion at an early (2 h) and late (24 h) stage, respectively, of acute inflammation of the oral soft tissues produced by injection, under sterile conditions, of 0.1 ml of staphylococcal toxin (LH-0.18, series 33, manufactured at the Gamaleya Institute of Epidemiology and Microbiology), diluted 1:5 with physiological saline, into the submucosa of the left transitional fold of the vestibular maxillary aspect at the site corresponding to the location of the first molar; 5 and 6) rats with pilocarpine-induced saliva secretion at the early (2 h) and late (24 h) stages, respectively, of acute staphylococcal inflammation of the oral soft tissues.

For synchronization of the secretory activity of the salivary glands, all rats were deprived of food for 24 h before the acute experiment, water being allowed ad libitum. Tissue pieces were taken from the ipsilateral (left) submaxillary gland and oral mucosa of animals under nembutal anesthesia (40 mg/kg). For 40 min prior to tissue sampling, mixed saliva was collected from rats with induced saliva secretion, using a special stand [3]. Sampling of the biological material was performed in the morning, taking into account the circadian rhythms. In the biological material obtained, the protein content was determined after Lowry [4].

RESULTS

As is seen from Table 1, the protein content in the glandular tissue of intact rats during basal secretion does not differ markedly from that during induced secretion, whereas a noticeable accumulation of protein occurs in the oral mucosa during the pilocarpine-induced secretory cycle. At the

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TABLE 1. Protein Content (mg/g Wet Tissue) in Tissues of Submaxillary Salivary Glands and Oral Mucosa and Protein Excretion (mg per 40 min) with and Concentration (μg/ml) in the Saliva during Acute Inflammation of Oral Soft Tissues ($M \pm m$)

Experimental conditions	Glandular tissue	Mucosa	Saliva	
			excretion	concentration
Intact rats with basal secretion	61.4±3.3 (11)	26.2±2.1 (11)	–	–
Intact rats with induced secretion	58.8±3.6 (11)	37.0±4.1 (11) p	748.5±96.1 (9)	1571.2±62.9 (9)
Rats with basal secretion at early stage of inflammation of oral soft tissues	73.7±6.5 (19)	18.3±4.0 (6)	–	–
Rats with induced secretion at early stage of inflammation of oral soft tissues	59.4±3.3 (9)	37.5±2.2 (12) p, p_1	934.4±187.8 (6)	1716.1±30.1 (6) p_3
Rats with basal secretion at late stage of inflammation of oral soft tissues	62.1±5.8 (7)	26.1±4.1 (7)	–	–
Rats with induced secretion at late stage of inflammation of oral soft tissues	81.3±8.6 (8) p_1, p_2, p_3, p_4	56.9±3.7 (8) p, p_2, p_3, p_4	886.6±180.8 (8)	1446.7±74.4 (8) p_4

Note. Reliability of differences: p: vs. intact rats with basal secretion; p_1: vs. rats with basal secretion at early stage of soft tissue inflammation; p_2: vs. rats with basal secretion at late stage of soft tissue inflammation; p_3: vs. intact rats with induced secretion; p_4: vs. rats with induced secretion at early stage of soft tissue inflammation. Number of animals shown in parentheses.

early stage of the inflammatory process (2 hours) the protein content in the glandular tissue and mucosa did not markedly differ from the control, although at this stage edema was clinically established on the side where the phlogogenic agent had been injected. The latter is evidence that during this period of the secretory cycle the mucosa entirely preserves the normal ability to accumulate proteins. More marked changes were revealed in the late stage of acute inflammation of the oral soft tissues, when edema was noted not only on the ipsilateral but also on the contralateral side. At this stage the protein content in the salivary gland tissues and mucosa during basal secretion did not differ markedly from the control. Nevertheless, during induced secretion the protein content appreciably increased not only in the oral mucosa but also in the salivary gland tissue. In this connection it was of interest to elucidate whether the protein accumulation in the salivary gland tissue went along with changes of protein excretion with the saliva during the secretory cycle. However, the results of experiments showed that the salivary protein concentration slightly increased just at the early stage of inflammation (Table 1), and this was not reflected in the protein content in the mucosa. At the late stage the concentration and excretion of protein with the saliva reverted to the initial level.

Thus, the data obtained demonstrate that during acute inflammation localized in the oral soft tissues, protein excretion with the saliva is not markedly impaired during pilocarpine-induced secretion. During the secretory cycle, pilocarpine promotes a weak protein accumulation in the intact mucosa; during acute inflammation of the oral soft tissues, it increases the ability of the mucosa to accumulate protein, the tissues of the salivary glands also being involved in this process. There is thus evidence that the use of pilocarpine as an M-cholinomimetic not only causes a secretory response on the part of the salivary glands, but also increases the permeability of the blood vessels [5], specifically for inflammation of the oral soft tissues, when vasoactive inflammatory transmitters are released. Such an effect of pilocarpine probably enhances the defense of the salivary glands and oral soft tissues due to the increased protein concentration in the interstitial space.

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